

OSTEOTOMY

FOR

ANTERIOR CURVATURES OF THE LEG

BY

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PHILADELPHIA

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L. P. KELLOGG AND SON

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ONE of the most frequent deformities produced by rickets is a forward arching of the bones of the leg, which deviation is very often associated with a lateral curve of both tibia and fibula.

Rickets is a constitutional disease, and is so seldom seen in country practice in healthy districts, that physicians frequently overlook the early symptoms, which are manifested by an indisposition of the child to be lifted, by peevishness, and by general symptoms of mal-nutrition. Ordinarily these conditions are attributed to indigestion, and certainly the stomach and intestines are largely at fault in the production of this state of defective digestion and still more defective assimilation; but simple indigestion does not give the beaded ribs or "rickety rosary," the softened cranial bones, the cranio-tabes, the lengthened dolichocephalic skull, the open fontanelles, the softened bones, the excessive head sweatings, the flabby muscles, and the enlarged epiphyses,—deformities so characteristic of rhachitis. Rickets is essentially a disease of early childhood, is rarely congenital or hereditary, and only occasionally develops at or after puberty. It differs entirely from either tuberculosis or scrofulosis.¹ In small cities it is rare; in larger ones it is found in proportion to the existing amount of filth, squalor, bad air, scanty food, and deficient light. When found in the rich, it can be traced to improper non-fatty food or hygiene. In this country the colored race is more affected than the white, and the results are also more serious.²

¹ Ashhurst, *International Encyclopædia of Surgery*, vol. i. p. 251.

² *Transactions American Surgical Association*, 1887, p. 261.

While it is a constitutional disease affecting all the tissues of the body, yet its worst manifestations are exhibited in deformities of the bones. These deformities are due to the relative preponderance of the organic over the earthy tissues in the bone, and the failure of the formative cartilage cells to produce true bone cells. This is the stage of softening; and during its progress, if the child is allowed out of bed, the osseous tissues are unable to sustain the superincumbent weight and consequently easily yield to a greater or less degree. Not only do the tibia, fibula, and femur become bent, but the pelvis is deformed; and either from creeping or from being lifted, the humerus, or the radius and ulna of the patient, may also be distorted. In severe grades even the clavicles are arched.

Upon the resumption of proper assimilation, however, the deposit of earthy salts begins, and then follows the stage of *sclerosis*, or hardening, which permanently fixes the distorted bones in their faulty positions.

Among the most frequent of bone deviations are *anterior tibial curves*. These are not produced by contraction of the gastrocnemius, for the calf-muscles are at first flabby and only become shortened at a later stage. The distortion may extend in a long curve from knee to ankle, or it may be abrupt and angular at any portion of the bone, usually the lower third.

The treatment of these anterior curves is accomplished by

I. MANUAL STRAIGHTENING AND THE USE OF APPARATUS.

In the second and third years of life, if the bones are still either soft or springy, it is possible to correct the deformity by frequent manual straightening, provided the mother or nurse is willing to give the requisite time and patience to the case. The pressure should be as forcible as the integrity of the bone will permit; this will give the child pain for only a few moments after the force is removed. This pressure should be repeated many times daily. If gentle manual pressure could be constantly applied, it would doubtless, as in club-foot, be perfectly curative. Instrumental pressure, made in the proper direction by spring power or by strap connected with steel uprights,

may be employed, in connection with manipulation, during this stage.

After the bone has hardened, however, I agree with Gibney¹ in saying that I have never seen a case of anterior curve of the tibia of any magnitude reduced by apparatus. Many surgeons spend months in attempting to straighten the bones in these cases, and then condemn the patient to perpetual cripplehood; whereas a slight operation will produce a perfect cure. The conditions are mechanically entirely different from those met with in legs bowed laterally.²

II. FORCIBLE FRACTURE.

A. *By the Hands.*

B. *By the Osteoclast.*

A. *Manual Fracture.* — In children under three years of age, by far the safest and best plan to be adopted, is fracture of the two bones at the proper point, if the surgeon possesses the requisite strength. For additional power the knee may be used, or the child may be placed upon its face and a very small sand-bag, or a wide roller bandage, be used as a fulcrum. Frequently it is timidity rather than lack of strength that prevents success. Up to the point compatible with the life of the soft parts, its great advantage lies in the fact that only a simple fracture is produced, and speedy union is the result.³ The objection to the plan lies in the inability of the surgeon to regulate exactly the point of fracture.

The proper dressing after manual fracture is fixation, as described under osteotomy.

B. *Osteoclasis.* — The osteoclast, while a very efficient instrument in the thigh, yet in the leg has the great disadvantage that pressure must be made upon the sharp edge of the tibia covered only by thin skin. It offers the advantages, however, that in the centre of the bone, pressure can be applied to a definite point,

¹ Transactions Academy of Medicine, New York, 1886, vol. xlv.

² Medical and Surgical Reporter, July 25, and August 1, 1885; Archives of Pediatrics, 1885, p. 680.

³ Dublin Journal Medical Science, vol. lxxix. p. 483.

and that its resultant is a simple fracture, provided sloughing is avoided. When the apex of projection is near to either epiphysis, however, neither the Rizzoli pattern nor any of its modifications is easy of adjustment.¹

III. OSTEOTOMY.

A. *By chisel*: 1. Simple. 2. Cuneiform.

B. *By saw*.

A. *By chisel*. — Both simple and wedge osteotomy necessitate the production of a compound fracture; but in the former the operation is almost subcutaneous, and in the latter there is the absence of contusion and other ordinary accompaniments of such an injury. The results may therefore be expected to be very much better, provided strict asepsis is enforced.

The procedure which I have found most effective is as follows:

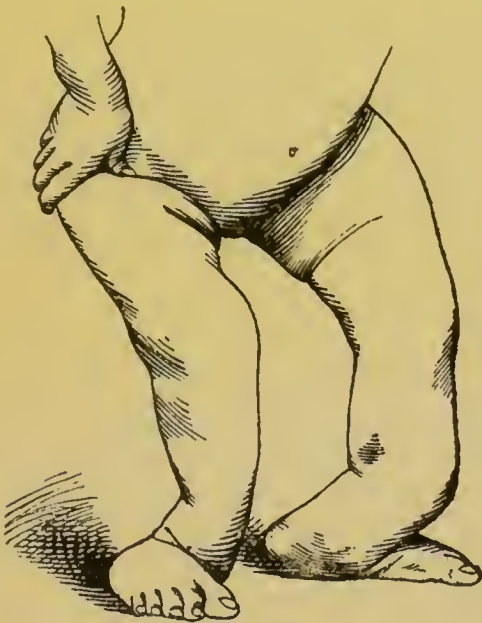
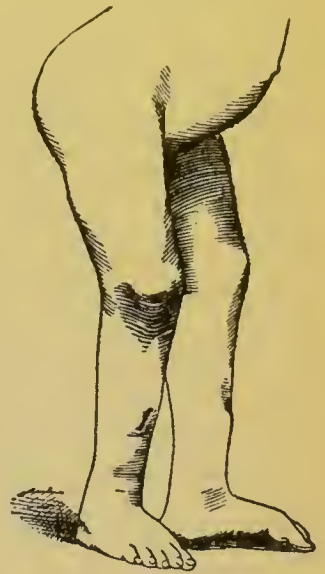
On the day previous to the operation the leg should be shaved, then washed with soap and water and afterward with ether, after which it is enveloped in towels which have been dipped in sublimate solution (1-2000), and then dried. These will remain *in situ* until the patient is etherized, when the final washing with bichloride (1-1000) is made. Instruments are first to be placed in boiling water, then in carbolic acid solution (1-20). The rubber cloth should be placed on top of the sand-bag, and then covered with a single layer of wet bichloride towels. The region of the operation should be well surrounded with carbolated towels. One of the osteotomes should be both wider and thicker than the other, the latter being used in the deeper portion of the section so as to prevent wedging. I have never been unfortunate enough to break off an instrument in the bone; but this accident has occurred in the practice of experienced surgeons, and a portion of the chisel has been allowed to remain. I should prefer to loosen and remove it by cuts alongside.

The osteotome should taper gradually, not abruptly, and should be driven by light taps of the mallet after the anterior cancellous tissue has been passed, lest a splintering or a long oblique fracture be produced. Several times while rapidly demonstrating

¹ New York Medical Journal, 1886, vol. xliii. p. 129.

this operation to a class, I have in the cadaver made a fracture that extended obliquely for many inches. The posterior one-fourth of the bone should always be fractured manually, lest the instrument injure the artery, which, from displacement, may lie directly behind or alongside the bone. Dandridge¹ was unfortunate enough to lose a patient from pyæmia, after an injury of the posterior tibial artery and vein, which both lay directly against the tibia.

1. *Linear Osteotomy.* — In simple osteotomy an Esmarch bandage is not desirable, as the outflowing blood is of advantage in effectually preventing the entrance of air.

FIG. 50.²FIG. 51.³

In regard to the cases suitable for the simple cut, experience has taught me that even where the angle has been very promi-

¹ Boston Medical and Surgical Journal, 1885, vol. cxiii. p. 25.

² Fig. 50 shows only the lower half of the body; but in this case nearly every long bone was curved. Locomotion was impossible except with a waddling gait and with the trunk supported upon the thighs by the hands. When the patient stood, each tibia rested upon the dorsum of the foot. Both legs were "cork-screwed," and the femora bent both outward and forward. All the epiphyses were enlarged, and the elbow articulation was so distorted that the arms could be only partly flexed. Both clavicles were sharply bent forward at their centres.

³ Fig. 51, from a photograph, shows the result of the osteotomies in case shown in Fig. 50.

nent, there is no necessity for taking out a wedge, as Nature is abundantly able, provided no septic influence is introduced, to unite the bones solidly even if they were angularly placed. The incision with the knife should be directly down through the periosteum, and should be no longer than just sufficient to permit the osteotome to turn crosswise without tension. In children the fibula need not be touched, as it can be easily fractured; but in the sclerosed bones of lads or adults, a separate section will be necessary. The larger osteotome should not be removed from the bone until more than one third of the diameter has been traversed, although it should frequently be moved sidewise to prevent wedging, and to incise different portions of the structures in large bones. The smaller instrument should be carefully inserted in the exact track of its predecessor.

An operator soon learns to distinguish the increased density of the compact tissue when the posterior region is reached, and will withdraw the osteotome before it has penetrated this layer, when fracture will readily complete the solution of continuity.

Rectification being now performed, section of the tendo achillis is usually done with benefit, as it relieves much of the tension upon the parts, permits better adjustment, and reduces the tendency to future displacement. Irrigation with sublimate solution should be frequently practised during the progress of the section; and upon the withdrawal of the instrument an aseptic sponge should at once close the wound, and remain in position.

Without waiting for hemorrhage to cease, unless it be profuse, all tissue is removed from between the edges of the wound, a few strands of catgut introduced, and the lips drawn together by catgut suture or strip of adhesive plaster — preferably the former. Irrigation should be continued until the sublimate gauze (freshly wet, in children, with 1-2000 solution) is actually in place.

I have abandoned both protective and iodoform. Dry sublimate cotton is now applied as a roller to the leg and foot, and is held in position by an antiseptic or a flannel bandage.

Plaster-of-paris rollers soaked in warm salt water are now applied, the limb is extended, and the deformity *slightly overcorrected*, until fixation is complete. To insure accuracy of position

the plaster eneasement of the leg should first be completed; an assistant then rests the heel of the patient upon the thumb and finger of one hand and grasps the toes with the other, which position he must maintain during the envelopment of the foot and the setting of the plaster. As a rule, but little morphia will be required, and if no pain or odor is present, and the temperature is good, the surgeon will have little to do for four or five weeks, as the ease progresses to good union without suppuration.

The temperature chart is not an infallible guide as to the condition of the parts, yet it is one of the best indications; and if no evidences of suppuration exist, the dressing need not be interfered with, as disturbance of any wound, so long as it is sweet, is harmful. Should the cast become loose, it should be sawed open, the leg examined to see that good position is maintained, and the eneasement drawn closer together by a bandage.

If other osteotomies are to be performed at the same operation, each fracture as it is produced should be wrapped in a sublimated towel, while a pledget of antiseptic cotton is fastened over the wound. A temporary wooden or pasteboard splint should be applied, lest in the manipulations of the subsequent operations the muscles and possibly the blood vessels should be lacerated by a sharp-pointed fragment.

2. *Cuneiform Osteotomy*. — The removal of a wedge-shaped piece from the tibia is only necessary when the angle of curvature is very great, and especially when it approaches the right angle. To determine the amount of bone necessary to be excised, one soon learns to judge with sufficient accuracy by his eye. If exactness is desired, the sphenometer¹ may be used, or the anterior surface of the limb may be outlined upon a piece of stiff paper. This line, paralleled by one at about the supposed antero-posterior diameter of the tibia, will give the size of this bone. When the pattern is cut out as drawn, a rude representation of the tibia will be secured which, when cut through at the point of the curvature and straightened, will at once show the size of the wedge.

As a cuneiform section is much more serious than simple osteotomy, every aseptic precaution should be used to prevent

¹ Therapeutic Gazette, 1887, p. 154.

suppuration. These have already been enumerated. The application of a sterilized Esmarch bandage assists greatly in the proper formation of the wedge, by giving a good view of the cut bone surfaces. A chisel, bevelled upon one side, is used instead of an osteotome.

If rigid, and in large children, the fibula should be first divided, but the removal of a wedge from this bone is never necessary. The knife incision over the tibia should be a little larger than the proposed base of the wedge, and the periosteum should be cut not only longitudinally but also laterally, in order that it may be preserved intact without laceration, and that it may be subsequently sutured.

The wedge is not taken away entire, but is made rather by a series of chippings until the proper amount is removed.

The posterior portion of the bone is fractured by manual force, as in simple osteotomy. If the instrument is driven too rapidly, or carried too deeply into the bone, a very oblique fracture may result. Tenotomy of the tendo achillis should always be performed if there is any restraint against rectification.

Many surgeons fasten the ends of the bones with wire,¹ silk-worm gut, kangaroo tendon, etc.; but I see no necessity in the majority of cases for the delay and for the additional incentive to suppuration. In angular malunion following fracture, however, I always use the inter-osseous suture, as there is ordinarily a tendency to non-union. Upon the removal of the Esmarch bandage the hemorrhage will be very free from the cut surfaces, but hot water or eburnation will usually arrest it. Stuffing the wound with alum gauze is rarely if ever necessary, and if it is used the material should be removed within twenty-four hours. Drainage, while unnecessary in simple osteotomy in which organization of blood-clot will occur, is here of the greatest importance for the prevention of suppuration.

All fragments of bone should be thoroughly removed by irrigation (with 1 to 2000 sublimate solution, in children), and the ends brought closely together *without any pinching of tissues*. A failure to observe this rule will ensure defeat, as will also the

¹ St. Bartholomew Hospital Reports, 1886, vol. xxii. p. 40; also 1884, vol. xx. p. 59.

retention of any tissue in the lips of the wound when it is closed by catgut sutures. Either sterilized horse-hair or catgut may be used for drainage; I prefer the former.

When there is an opening at the fibula a roll of horse-hairs is carried into the tibial wound with a pair of forceps, and made to emerge at the opening of the former; another small bundle is carried directly through from the bottom of the wound to the posterior aspect of the leg through a counter opening. Catgut may be allowed to remain permanently, although I prefer to take it away, as I do the hair, in thirty-six hours.

In applying the dressings, the same thorough precautions are necessary to obtain asepsis until the moment that the wound is covered with gauze. The sublimate cotton, plaster bandage, etc., are applied as before, except that the latter is put on as a recurrent longitudinally along the sides of the limb at the seat of operation, in order to give additional strength laterally. In front and behind, at the site of the proposed windows, the cast is made thinner and the ends of the horse-hairs arranged so that they can be withdrawn without interference with the remainder of the dressing.

A slight overcorrection of the deformity is advisable while the plaster is setting, and extension should also be made in order to secure good apposition of the fragments. When windows are cut in the cast on the second day, the staining of dressings with blood does not necessitate their removal so long as decomposition has not taken place. A moderate wetting with sublimate solution after the withdrawal of the drain will prevent all odor for a week or ten days, when union of the soft parts will have occurred, and a fresh dressing may be applied through the opening. Care should be taken that pressure should be accurately made upon the tissues beneath the window, lest local œdema and pain ensue. Usually these cases go on to speedy and perfect union. Occasionally, through some fault in the operation or in the dressing, suppuration ensues, in which case the cast about the opening should be coated with shellac, the wound thoroughly washed and antiseptically dressed, when the cessation of pus formation may be soon secured.

In the case from which the accompanying figures were pre-

pared, while one limb healed kindly, the other suppurated, and several particles of bone were discharged; nevertheless, a perfect union and a good leg resulted.

I have never ventured beyond six osteotomies at one time, but as high as ten have been performed.¹ It is my custom to rec-

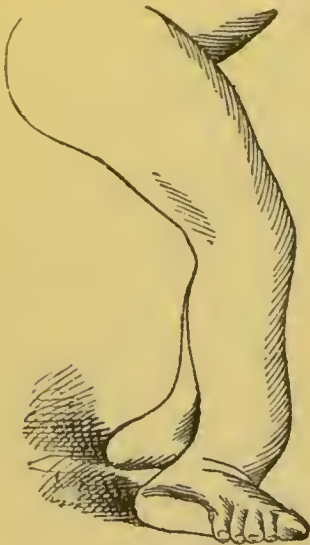


FIG. 52.

Double knock-knee, with double anterior curves.

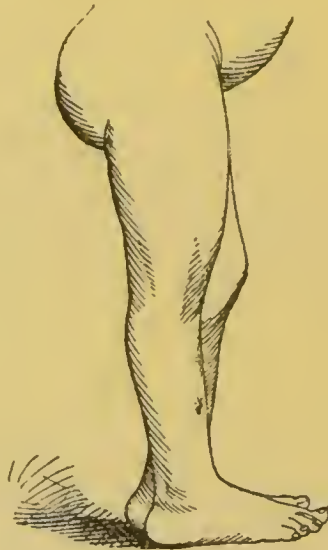


FIG. 53.

After osteotomy.

tify coexistent knock-knee by a simultaneous supra-condyloid osteotomy (Figs. 52 and 53); but I have always left the high curve which so often exists in the femur, intending to do section later. Thus far, however, all my cases have been so greatly improved in locomotive powers that I have hesitated to incur the possible risk of rotation of fragments or of placing the head of the femur after reunion in a new relation to the acetabulum; and have also reasoned that as both pelvic and thigh muscles had for years accommodated themselves to the abnormal positions, more or less disability might occur by throwing them into new mechanical relations. All my sections at the upper end of the femur have been for hip-joint ankylosis, and in cases in which I did not expect to secure the proper apposition of femoral head and acetabulum, since both had been either greatly altered or already destroyed.

¹ Dublin Journal Medical Science, vol. lxxix. p. 292; MacEwen, Transactions of Eighth International Medical Congress, Copenhagen, 1884.

B. *Section with the Saw.* — Several very oblique fractures which have recently been produced by me in making sections of the bones by the osteotome and chisel, in which very sharp ends of fragments have rendered injury of the soft parts and blood vessels imminent, have led me to look favorably upon the operation with the saw. I have never practised it upon the leg bones, although frequently employing the saw on other bones. The section could be performed almost absolutely subcutaneously, and I have never had suppuration follow its use in other cases. The saw should be blunt-pointed, should have a short cutting face, and the puncture with the knife should be only just large enough to admit the saw. Care should be exercised that neither blood vessels nor nerves are injured.

Will the deformity return? Doubtless, if too early locomotion is attempted without support, or if a febrile or other exhaustive disease speedily follows the operation. Such a softening of the callus before it is thoroughly ossified is possible after any fracture, but is rare. Should it accidentally occur, the case should be treated as one of malunion or of delayed union: that is, first, by re-position and fixation with gypsum; then, secondly, by open osteotomy and wiring of fragments, with long-continued subsequent support.

Conclusions. — 1. Anterior tibial curves during the soft and springy stages may be corrected by manual rectification and the use of apparatus.

2. Instrumental pressure is useless after hardening has occurred.

3. Manual fracture is the best and safest remedial operation in young children.

4. Instrumental fracture, or osteoclasis, is not as safe or effective as osteotomy.

5. Aseptic simple osteotomy, for all moderate degrees of curve, and euneiform section for very severe grades, give almost uniformly good and speedy results, without suppuration. Subcutaneous section by the saw is also a reliable operation.

6. Plaster of paris is the simplest and most effective material for securing accurate position and maintaining absolute fixation. By its use the delay and injury incident to suturing the ends of the bones is avoided.



